Title: High-Voltage Electrostatic DC Generators: A Survey
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HIGH-VOLTAGE ELECTROSTATIC DC GENERATORS: A SURVEY

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[Note: The above is the title of an article appearing in Zhurnal Tekhnicheskoy Fiziki, Vol X, No 3 (1940), pages 177-196, which is available as a photostat No P-16429.

The table of contents of this article is available in the U-report U-1261, which report also contains the last (namely, 10th) section translated in toto.

Sections 1 to 4 are found to contain essentially the same material as given in previous reports on electrostatic generators; namely, in the following:

1. U-1197 (High-voltage Condensers with Compressed-Gas Insulation, by B. M. Gokhberg, H. M. Reynov and M. P. Glikina, from ZhTF Vol XII, No 1 (1942), pages 8-13).
2. U-1240 (Models of High-Voltage Electrostatic Generators Operating in a Fluid Dielectric, by B. M. Gokhberg, A. F. Ioffe and M. M. Reynov, from ZhTF Vol IX, No 23 (Nov or Dec 1939), pages 2081-9).
3. U-1226 (The Electrostatic Generator, by A. F. Ioffe, from ZhTF Vol IX, No 23 (Nov/Dec 1939), pages 2071-2080).
4. U-1259 (Models of Multi-Disc High-Voltage Electrostatic Generators, by B. M. Gokhberg, A. F. Ioffe and N. M. Reynov, from ZhTF Vol IX, No 23 (Dec 1939), pages 2094-2103).
5. U-1246 (High-Voltage Electrostatic Generators Filled with Kerosene, by B. M. Gokhberg, S. A. Bobkovskiy, A. F. Ioffe and N. M. Reynov, from ZhTF Vol XI, No 23 (1939), pages 2090-3).
6. 00-W-16544 (Elegas, by B. M. Gokhberg, from Elektrichestvo, No 3, 1947).
7. 00-W-16589 (Scheme for High-Voltage Electrostatic Generator with Grounded Metal Shaft, by B. M. Gokhberg and A. F. Ioffe, from ZhTF Vol XI, No 7 (1941), pages 617-8).
8. 00-W-15059 (Electrostatic Generators: A Review, by Ya. M. Chervonenkis, from Elektrichestvo, No 11, 1948, pages 80-1).

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Finally the remaining five sections -- namely, Sections 5 to 9 -- are briefly abstracted below. They contain mainly the information already given in the above-listed reports and data on mainly non-Russian generators. The original sections were subdivided into subsections (Soviet and non-Soviet (chiefly American)) describing individual generators. The subdivisions given below agree with those in the original text. Full translations were made only of subsections describing Soviet-made generators (see Appendix).]

Section 5. Belt Generators Operating at Atmospheric Pressure

A. Small Generators up to 1000 kv

a. American

b. American

** c. Kharkov generator constructed by Ukrainian Physical Technical Institute (Note: see appendix for description).

d. French

e. German

f. American

B. Generators with Voltages from 1000 to 2000 kv

a. American

b. American

c. American

** d. Two-pole generator constructed by Ukrainian Physical Technical Institute (Note: see appendix for details).

e. American

f. American

C. Giant Generators

a. American

** b. Kharkov generator constructed by Ukrainian Phys-Tech Inst.

c. French

Section 6. Belt Generators Operating in Compressed Gas

(Note: four subsections on four American models.)

Section 7. Generators with Gas Jet

(Note: three subsections on three models, American and French.)

** (Note: described in attached appendix.)

Section 8. Generators with Rigid Rotor

a. American

Section 9. Generators with Cylindrical Rotor

a. Model of the Leningrad Physical Technical Institute (Note: for a description see U-1249 mentioned above).

Section 10. Applications of Electrostatic Generators

(Note: for a complete translation see U-1261.)

APPENDIX [Note: Below are descriptions of the three Kharkov generators mentioned above in Sec 5Ac, Sec 5Bd, Sec 5Cb, as marked with asterisks.]

Sec 5Ac. Kharkov generator constructed by Ukrainian Physical Technical Institute (Small belt generator up to 1000 kv operating at air pressure):

The general view of the generator is shown in Figure 5 of the original. A spherical conductor 720 mm in diameter (concave near the support) was installed on an insulated support consisting of an isolite cylinder 350 mm in diameter and 1150 mm high with a wall thickness of 5 mm. The length of the effective insulation was 1000 mm. The rubber belt 200 mm wide moved 33 meters/sec. Ordinary belt speeds were 25 meters/sec. The drum that set the belt into motion was rotated by means of an induction motor of 250 watts. Installed on a mobile platform was a generator with a primary high-voltage supply equal to 20 kv. At the left of the generator (see Figure5) a vacuum discharge tube was installed consisting of porcelain sectional ribbings. Maximum voltage at the negative pole was 700 kv, and at the positive the maximum voltage was 620 kv. The short-circuit current was 400 micro-amperes. For a load of 200 micro-amperes the generator gave a voltage equal to 600 kv and operated stably at humidity 50-55 %. The Ukrainian Physical Technical Institute has constructed a total of four such generators.

Sec 5Bd. Two-pole generator constructed by Ukrainian Physical Technical Institute (Belt generator operating at air pressure with voltages from 1000 to 2000 kv):

The Ukrainian Physical Technical Institute assembled a two-pole generator of 1,500,000 volts with toroid conductors 2200 mm in diameter and 1200 mm high and supported on an isolite cylinder 720 mm in diameter and 1900 mm high. Three independent belts 450 mm wide were installed inside the support. For low speeds of the belt (8 to 9 m/sec) the generator gave a maximum current equal to 0.3 milliampere. The secondary voltage of each conductor toroid was 900 kv at the negative pole and 800 kv at the positive pole. The distance between the lateral surfaces of the conductors was 2800 mm. The sectional cathode-ray vacuum tube was located horizontally between the

conductors . The tube was assembled from metallic disks and glass cylinders and was degassed from the central part because the terminals of the tube were under high voltages. The measuring instruments were located within the conductors, which could also hold the experimenter. The voltage of the tube did not exceed 1000-1200 kv during steady operation. The current density of the electron beam emitted through an aluminum foil 0.05 mm thick was of the order of 0.1 to 1.0 milliampere.

Sec 50b. Kharkov generator constructed by the Ukrainian Physical Technical Institute (Belt generator of giant size operating at air pressure):

Subject generator was constructed in 1936 and tested in 1937. The general view of this generator is shown in Figure 17. A ten-meter conductor is installed on three insulating supports made of isolite, the diameter of each support being 2 meters at a height of 10 meters. The supports are installed in a triangular pattern with 3 meter distance between the axes of the supports. Each support contains six multilayer rubber belts inside of the support where the air is carefully air-conditioned. The widths of the belts are from 920 to 1200 mm. Stable operation was at 20 to 25 meters/sec. The cathode-ray tube was located between the insulating supports and consisted of 18 porcelain cylinders of 18 sections. Peak voltages without the tube reached 4,000,000 volts during tests on the generator, further increases being limited by the protruding beams of the ceiling. With the tube the peak voltages were around 3,000,000 volts for short periods of time and 2,600,000 volts for longer periods of operation. Thus the tube limited the peak voltages. The electron current within the tube was about 0.1 milliampere; and a current of about 0.1 milliampere flowed along the distributing apparatus: therefore the charging current was only about 0.2 milliampere, which corresponded only to 15% of the current supplied by only three belts (the usual number in operation). In tests without the tube the spark from the sphere jumped 7 to 10 meters.

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